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Supernova-relevant hydrodynamic instability experiments on the Nova laser,* S.G. Glendinning [1], W.D. Arnett [2], R.P. Drake [4], K. Estabrook [1], J. Kane [2] , E. Liang[6], R. London [1], R. McCray[5], B.A. Remington [1], A. Rubenchik [3]
[1]LLNL, [2]U. Arizona, [3]U.C. Davis, [4]U. of Mich., [5]U. of Colo., [6] Rice Univ.
Hydrodynamic instabilities have recently been highlighted as playing a critical role in the evolution of supernovae (SN). We have begun two experiments on the Nova laser to examine, under controlled conditions, our ability to predict hydrodynamic behavior at plasma conditions relevant to supernovae. In both experiments, the Nova laser is used to heat a cylindrical gold cavity either 1.6 mm diameter × 2.6 mm long or twice this size to a radiation temperature of about 220 eV (160 eV for the larger). This radiation source is used to generate high pressures (1-5 TPa) in planar packages designed to mimic various features of SN. The first of these experiments considers the role of hydrodynamic instabilities at the Rayleigh-Taylor unstable interfaces in type II supernovae such as SN1987A. We have observed and will report instability growth of single modes and isolated structures at a Cu-CH_2 interface and have begun a comparison between two-dimensional and three-dimensional structures. The second experiment examines the strong shock hydrodynamics generated by the interaction between supernova ejecta and the stellar wind of the SN precursor. We have observed the density discontinuities produced by the forward and reverse shocks in a plastic-foam system. *Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under contract number W-7405-ENG-48.